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RAIL SHIPPING TESTS WITH LONG ISLAND CAULIFLOWER, 1949

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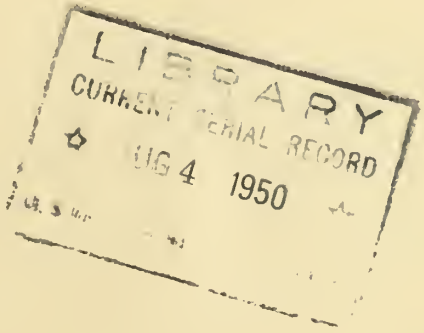

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Rail Shipping Tests with Long Island Cauliflower - 1949 1/

The poor arrival condition of many rail shipments of Long Island cauliflower during the season of 1948 brought requests for assistance in determining how such losses could be avoided.

A survey of harvesting and marketing procedures in the Riverhead area suggested the importance of reducing the long delay between the time the crates are packed and when they are placed under ice in loaded cars. However, there did not appear to be any practicable way to accomplish this under the prevailing sales practices. Attention was therefore directed to the possibility of bringing about better cooling of the load by (1) use of both bunker ice and top ice, and (2) modifying the loading arrangement to permit better air circulation within the load.

It was planned to make temperature studies with resistance-thermometer equipment so that temperature readings in certain parts of the load could be made from outside the car after the doors were closed. Paired cars, alike in every respect except for the particular modification under study, were to be shipped at regular intervals to the Chicago market where Department investigators were available for making readings of arrival temperatures, removing test equipment and comparing the two loads, and where laboratory facilities were available for holding tests. Because of market conditions it was necessary to modify these plans. One pair of test cars was shipped to St. Louis, and transit temperature records were obtained by means of Ryan thermographs in seven other commercial carlots which went to a number of midwestern and southern markets and which represented variations in loading and icing methods.

This preliminary report summarizes the information that was obtained from the nine test cars and suggests modifications of the present commercial practices that may aid in improving the arrival condition of the cauliflower.

Current Practices in the Riverhead Area

The standard container in use is the Long Island wirebound crate having outside dimensions of approximately 24 x 13-1/2 x 15-1/2 inches which holds 12 heads of cauliflower and has a gross weight of approximately 59 pounds when packed.

Harvesting is done during the forenoon of the day of sale or it may be done during the preceding afternoon. The cauliflower is sold by truckload at auction. The Riverhead auction, where most of the cauliflower is sold, is held in the early afternoon. Following the sale, cauliflower destined for rail shipment is trucked to near-by tracks, loaded into dry refrigerator cars, and 12,000 to 18,000 pounds of snow ice is blown over the top of the load. Ordinarily the top ice is not replenished during transit. Cauliflower harvested on the day of sale is generally not iced until six to nine hours (or even longer) after the time of harvest. If harvested on the afternoon

1/ Part of a Research and Marketing Act project on the handling, distribution and marketing of vegetables in the Northeastern States.

preceding the day of sale the cauliflower may be in the crate even 12 to 18 hours longer before being iced.

The standard 400-crate through load is the one generally used. It consists of 16 stacks, in all but one of which the crates are loaded lengthwise on their sides, 7 rows wide, 4 layers high in 9 stacks and 3 layers high in 6 stacks. The crates in the 16th stack are loaded on end, 7 rows wide and 3 layers high. A single crate is usually placed loose somewhere on the top layer to complete the load of 400 crates. It is an exceptionally tight load, with practically no space between crates a[illegible]s not stripped.

Description of Tests

As indicated above, transit temperature records were obtained in nine carlots. Although no attempt was made to arrange for cars of any specific series, there was some opportunity to select cars that were considered to be in good condition and that were generally representative of those available for the cauliflower movement. Two of the cars used were equipped with built-in Preco fans. Pertinent information on the nine cars is summarized in table 1.

Six of the cars were loaded in the conventional manner with 400 crates. A modified load of 381 crates was used in three cars. In this load the crates are placed lengthwise on sides in 15 stacks, 6 rows wide and 4 layers high; and upright on end in one stack, 7 rows wide and 3 layers high. It should be pointed out that in both types of load there is occasionally some slight modification of the loading plan at the doorway. The important difference between the two types of load lies in there being one less row in the 381-crate load. This permits air channels approximately three inches wide between rows of crates extending from top to bottom and from end to end of the load. Also, in the 381-crate load some of the top ice undoubtedly finds its way into the channels between the crates.

Six cars were top-iced only and three cars were both top-iced and bunker-iced. Heavy paper was tacked over top and bottom bunker openings in the cars that were top-iced only.

Two Ryan thermographs were placed in each car. One was placed inside a crate in the second layer (from bottom) centerline, quarterlength position; the other was placed within a crate, at the side of the car, at the doorway position in the bottom layer. In cars 6 and 7 both Ryans were placed at the quarterlength centerline position, in the bottom and the next to the bottom layers respectively. Each of the latter two cars was also equipped with a set of twelve resistance thermometers attached to a master cable leading outside the car. Nine of the thermometers were inserted into heads of cauliflower in the top, next to top, and bottom layer crate at the bunker, quarterlength and doorway centerline positions respectively. The other three were used to obtain air temperatures at the top bunker, bottom bunker and top doorway positions respectively. Precautions were taken to keep the sensitive bulb of the resistance thermometers from direct contact with the ice. The loads in these two cars were similar in every respect. One car received 18,000 pounds top ice, the other 10,500 pounds top ice and 11,200 pounds of bunker ice.

Results with Seven Cars containing only Ryan Thermographs

The information obtained from the seven cars in which only Ryan thermographs were used consisted largely of a set of "case history" records. These are of considerable interest, but can not be fully used for direct comparisons in view of the nature of the tests. Information about the condition of the load and amount of ice remaining at destination usually was obtained from the shipper or from the consignee. In several instances destination inspection reports were made available by either Federal or railroad inspection agencies. In connection with the temperature records it should be pointed out that the bottom doorway position at side of car is probably not representative of much of the load but that the temperature at the centerline quarterlength location in second layer from bottom is quite representative of the bulk of the load.

Cars 1 and 2

These two cars had been precooled for six and one-half hours on the day previous to shipment by means of portable fans suspended in the bunkers. Each car was iced with 3,000 pounds of top ice. Car 1, shipped to St. Louis, received a total of 12,600 pounds of bunker ice and Car 2, shipped to New Orleans, received a total of 17,400 pounds of bunker ice. Both were fan cars but were inadvertently sent out by the shipper with fans in the "off" position. 2/ Commodity temperatures on day of shipment were 55° F. and 54° F. Both cars were shipped on the same day. From the summary shown in table 2 it can be seen that excellent temperatures in the middle thirties were maintained throughout the transit period. Destination reports indicated that in Car 1 the jacket leaves were fresh and green and the curds white, with no decay. There was little top ice remaining. In Car 2 the jacket leaves in top layer crates were reported somewhat yellowed, with many falling off when the cauliflower was handled; the rest of the load was in good condition. No top ice remained in this car at destination.

Car 3

The load consisted of 381 crates. It was top-iced with 24,000 pounds of snow ice but received no bunker ice. The cauliflower, which was 67° F. when loaded, cooled to 42° at quarterlength position after one day (table 2), to 36° after two days, and remained at 33° F. for the remainder of the transit period to Burlington, Iowa. Destination reports indicated that the cauliflower arrived in good condition and that there was an average of about 12 inches of top ice remaining.

Cars 4 and 5

Both cars were shipped on the same day to Des Moines, Iowa. Car 4 contained a 400-crate load, and Car 5 a 381-crate load. Each received 18,000 pounds of top ice. 3/ Exceptionally low commodity temperatures of 46° were noted in each car at time of loading. Both cars showed excellent transit temperatures (table 2). Destination reports indicated that the cauliflower in both cars arrived in good condition, with jacket leaves fresh and green, curds white, and no decay. An average of about thirteen inches of top ice remained in each car.

2/ This practice is not recommended.
3/ Neither car received bunker ice.

Cars 8 and 9

Car 8 contained a 381-crate load destined for St. Louis, and Car 9 contained a 400-crate load destined for Lincoln, Nebraska. They were shipped on the same day and had commodity temperatures of 55° at time of loading. Both were top-iced with 18,000 pounds and received no bunker ice. From table 2 it can be seen that decidedly lower transit temperatures prevailed in the 381-crate load, particularly at quarterlength position (second layer from bottom at centerline of car) than in the 400-crate load. Reports from destination indicated good arrival condition of the cauliflower in both cars and considerable top ice remaining.

In summarizing the results from the seven cars, it can be pointed out that good transit temperatures were obtained in 400-crate loads with both top-ice and bunker ice (cars 1 and 2) and in a 381-crate load with top ice only (car 3), but that some yellowing and shedding of leaves occurred in Car 2 in which no top ice remained at destination. Transit temperatures were much alike in Car 4 with the 381-crate load and Car 5 with the 400-crate load which received only top ice. However, the cauliflower was unusually cool (46°) when loaded. When a similar comparison was made a week later with Cars 8 and 9, having initial commodity temperatures of 55° F., transit temperatures were markedly lower in the 381-crate load than in the 400-crate load.

Results with Two Cars Containing Ryan Recording Thermometers and Resistance Thermometers.

The results obtained with cars 6 and 7 were of particular interest because (1) the loads were identical, (2) a more complete temperature record was obtained than in the other cars, and (3) the senior writer met the cars at destination and so had opportunity to compare arrival condition of the two loads.

Both cars contained 400-crate loads and were shipped together to St. Louis. The cauliflower was harvested during cool weather and had an average temperature of 45° at the time of loading. Car 6 received only 18,000 pounds of top ice; car 7 received 10,500 pounds of top ice and 11,200 pounds of bunker ice.

In table 3 are shown the temperature records obtained with electric resistance thermometers at nine points in the load during the first six hours after loading and the last forty hours before unloading while the cars were on track at St. Louis. These data show that the load in Car 7 (both top ice and bunker ice) cooled to a somewhat lower temperature than the load in the other car (top ice only) during the first six hours after loading, particularly at the bottom and top of the load. At the time of the first St. Louis reading (5:50-6:00 p.m. on November 11) there was a marked difference between the cars in the temperatures at all nine positions in the load. This remained true for most positions during the subsequent readings at St. Louis. During the forty hour period at St. Louis the average temperature of the load with both top ice and bunker ice was approximately 6 degrees cooler than the load with only top ice. A comparison of the data from the

two Ryan thermographs in table 2 shows that the temperatures in the load with both top ice and bunker ice were markedly lower than in the load with only top ice throughout the transit period and two days on track at destination. At the bottom quarterlength, centerline position, the daily difference was approximately 6 degrees and in the next-to-bottom layer, quarterlength centerline, it was 4.5 degrees. There was an average of 12 inches of top ice remaining in Car 6 and 8 inches in Car 7.

The difference between the two loads with respect to the arrival condition of the cauliflower was more striking than might have been expected from the temperature differences. In the car with both top ice and bunker ice the wrapper leaves were firmly attached and green in color, and the curd was creamy-white to white. About 1 percent of the heads showed early stages of bacterial soft rot. In the car with top ice only most crates examined had 1 to 12 heads with 3 to 9 jacket leaves yellow and loose, and the curds were creamy-white to white. These differences were readily apparent to the receiver who expressed a definite preference for the load that had both top ice and bunker ice.

Discussion and Conclusions

The evidence from these tests indicates that rail shipments of Long Island cauliflower to mid-western and southern markets, if loaded 400 crates to the car, should receive bunker ice as well as top ice. These tests were made during cool weather when commodity temperatures were fairly low at the time of loading. If warmer temperatures had prevailed the need for bunker refrigeration would probably have been even more striking.

Although the evidence is incomplete there appears to be a definite advantage in favor of the modified 381-crate load over the tightly packed 400-crate load. Whether or not shipments of the 381-crate load would profit by use of both bunker ice and top ice when warm weather prevails at the time of harvest has not been determined.

The results of the tests are sufficiently encouraging to warrant extensive trials with various modifications of icing practices on both types of load.

Cooperators:

Mr. A. Denholtz and Mr. N. Pendulik, Long Island Cauliflower Distributors, Riverhead.

Mr. F. A. Piehl, Western Weighing and Inspection Bureau, Chicago.

Mr. H. N. Renfro, Jr., U. S. Department of Agriculture, St. Louis.

The Railroad Perishable Inspection Agency.

Fruit Growers Express Company.

G. A. Marsh Company, Rudin Distributing Company, Baldwin-Pope Marketing Company, Wesco Foods Company, St. Louis, Mo.

Hoxie Fruit Produce Distributors, C. C. Taft Produce Distributors, Des Moines, Iowa.

Lagomarcino Grupe Company, Burlington, Iowa.

R. Guercio & Son, New Orleans, La.

Nemole-Robinson Company, Lincoln, Nebraska

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Table 1. Outline of tests with Long Island Cauliflower, 1949

Car	Date Shipped	Number of Crates	Destination	Refrigeration Top--Ice Lbs.	Refrigeration Bunker--Ice Lbs.
1 1/	10/27	400	St. Louis, Mo.	3,000	12,600 2/
2 1/	10/27	400	New Orleans, La.	3,000	17,400
3	10/31	381	Burlington, Iowa	24,000	-
4	11/1	400	Des Moines, Iowa	18,000	-
5	11/1	381	Des Moines, Iowa	18,000	-
6	11/7	400	St. Louis, Mo.	18,000	-
7	11/7	400	St. Louis, Mo.	10,500	11,200
8	11/8	381	St. Louis, Mo.	18,000	-
9	11/8	400	Lincoln, Nebraska	18,000	-

1/ Fan cars loaded on day previous to shipment and precooled 6 1/2 hours with portable fans suspended in bunkers.

2/

10/26	Riverhead	8,400 lbs.
10/27	Riverhead	4,200 "
	Total	12,600 "

3/

10/26	Riverhead	8,400 lbs.
10/27	Riverhead	4,200 "
10/28	Jersey City, N.J.	2,600 "
11/1	Radnor, Tenn.	1,500 "
11/2	Montgomery, Ala.	700 "
	Total	17,400 "

Table 2. Transit temperatures obtained with Ryan recording thermographs in nine cars of Long Island Cauliflower, 1949.

Car	Date Shipped	Outside Air Temp. °F.	Commodity Temp. °F.	Location of Ryan in load 2/	Temperatures at specified periods of time: Start °F.	12 Hrs. °F.	1 Day °F.	2 Days °F.	3 Days °F.	4 Days °F.	5 Days °F.	6 Days °F.	7 Days 1/ °F.
1	10/27	55	55	2 Q.L.	58	52	45	37	34	34	35	36	37
				DWS 3/	59	46	34	34	34	35	35	34	34
2	10/27	54	54	2 Q.L.	53	46	38	36	35	35	35	35	35
				DWS	51	41	35	33	33	33	32	32	32
3	10/31	68	67	2 Q.L.	67	56	42	36	33	33	33	33	33
				DWS	66	54	Pen defective - no record.						
4	11/1	47	46	2 Q.L.	47	39	35	34	34	34	34	34	-
				DWS	50	44	40	38	38	36	36	38	-
5	11/1	47	46	2 Q.L.	48	45	39	35	33	33	32	32	32
				DWS	48	44	37	36	36	35	35	35	35
6	11/7	55	45	2 Q.L.	44	42	44	45	46	46	46	45	45
				B.Q.L.	44	42	43	44	45	46	44	42	42
7	11/7	55	45	2 Q.L.	43	43	42	40	40	40	41	41	41
				B.Q.L.	44	41	37	37	37	38	38	38	38
8	11/8	64	55	2 Q.L.	54	47	38	34	33	33	33	33	
				DWS	57	51	40	35	35	-	-	-	
9	11/8	64	55	2 Q.L.	57	55	54	55	51	48	47	46	37
				DWS	56	48	34	32	33	33	37	36	34

1/ Transit period considered ended when the Ryans were removed either during a complete or partial unloading.

2/ 2 Q.L. = Quarterlength centerline position, 2nd layer from bottom; B.Q.L. = Bottom quarterlength at centerline.

3/ DWS = Doorway position at side of car, bottom layer.

Table 3. Summary of temperatures obtained with resistance thermometers in two cars of Long Island cauliflower, 1949.

Station	Date	Time	Outside air temp. °F.	Commodity temp. at specified location in load. 1/ TB	MB	BB	TQ	MQ	BQ	TD	MD	BD	Avg. Bot.	Avg. Mid.	Avg. Top
Car 6 - 400-crate load - Top-iced only															
Loading started		2:05 p.m.													
Rivrhd,N.Y.	11/7	3:30 p.m.	51	44.5	46.5	48.5	49.	45.	46.	50.5	50.	47.0	47.0	47.0	48.0
" Top-iced	"	4:55 p.m.													
"	"	5:25 "	-	48.5	47.5	47.5	50.	45.	46.	48.5	50.	47.0	47.0	47.5	47.5
"	"	6:05 "	48	43.5	46.5	46.5	49.	45.	46.	47.5	49.	46.0	46.0	47.0	46.5
"	"	7:05 "	46	42.5	46.5	46.5	49.	45.	46.	47.5	49.	46.0	46.0	47.0	46.5
"	"	8:35 "	45	41.5	46.5	46.5	49.	45.	46.	47.5	49.	46.0	46.0	47.0	46.0
"	"	9:15 "	-	41.5	45.5	46.5	49.	45.	46.	46.5	49.	46.0	46.0	47.0	45.5
St.Louis,Mo.	11/11	6:00 p.m.	71	39.5	38.5	46.5	45.	49.	48.	42.5	49.	49.0	48.0	45.5	42.5
"	11/12	10:30 a.m.	63	37.5	37.5	44.5	46.	48.	47.	42.5	49.	49.0	46.0	45.0	42.0
"	"	6:35 p.m.	57	37.5	37.5	41.5	46.	47.	46.	42.5	49.	49.0	45.5	44.5	42.0
"	11/13	9:50 a.m.	52	37.5	38.5	40.5	46.	46.	45.	42.5	49.	48.0	44.5	44.5	42.0
Car 7 - 400-crate load - Top-iced and Bunker-iced															
Loading started		2:00 p.m.													
Bunker-iced		10:00 "													
Rivrhd,N.Y.	11/7	3:35 "	51	47.5	46.5	45.5	47.	46.	44.	48.0	46.	44.5	44.5	46.0	47.5
" Top-iced	"	4:40 "													
"	"	5:00 "	48	46.5	46.5	44.5	46.	47.	45.	46.0	47.	44.5	44.5	47.0	46.0
"	"	5:30 "	-	44.5	45.5	43.5	44.	46.	43.	44.0	46.	43.5	43.0	46.0	44.0
"	"	6:00 "	48	45.5	46.5	44.5	45.	47.	44.	45.0	47.	43.5	44.0	47.0	45.0
"	"	7:00 "	46	43.5	45.5	42.5	44.	47.	43.	43.0	46.	43.5	43.0	46.0	43.0
"	"	8:30 "	45	41.5	44.5	40.5	42.	46.	42.	41.0	45.	43.5	42.0	45.0	41.5
"	"	9:15 "	-	41.5	44.5	40.5	42.	46.	42.	41.0	45.	42.5	42.0	45.0	41.5
St.Louis,Mo.	11/11	5:50 p.m.	71	35.5	35.5	34.5	37.	41.	39.	36.0	40.	40.5	38.0	39.0	36.0
"	11/12	10:35 a.m.	63	38.5	36.5	34.5	37.	41.	39.	36.0	40.	40.5	38.0	39.0	37.0
"	11/12	6:45 p.m.	57	-	36.5	34.5	37.	41.	39.	36.0	40.	39.5	38.0	39.0	36.5
"	11/13	9:55 a.m.	52	38.5	36.5	35.5	37.	41.	39.	37.0	41.	40.5	38.0	39.5	37.5

1/ Resistance thermometers located in top layer, middle layer (second layer from bottom) and bottom layer in centerline of car at bunker, quarterlength and doorway, respectively.